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Study on the Factors Influencing the Consumption of Safe Vegetables in Hochiminh City, Vietnam

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Abstract: The aim of this study is to determine why consumption of safe vegetables[1)] remains low despite Vietnamese consumers' wish to consume safe vegetables for the sake of good health. Multiple regression analysis was applied to analyze socio-economic factors that may influence the consumption of safe vegetables. Results showed that price, income, education, age and the number of presence children in a family significantly affected the consumers' decision to use safe vegetables. This study also revealed that there are many issues involved in the consumption of safe vegetables such as: consumers did not know well or trust the quality of safe vegetables; the price of safe vegetables is too high. Therefore, lowering the price; controlling the quality of safe vegetables; educating both producers and consumers about food poisoning and its effects would help to promote the consumption of safe vegetables.

Key words: Safe vegetables, Hochiminh, consumption, households

INTRODUCTION

Vegetables are a major component of the Vietnamese diet. Recently food poisoning caused by contaminated vegetables has been reported quite frequently. In the last several years, cases of food poisoning caused by unsafe vegetables have been exposed and widely broadcasted in the media in Vietnam. For example, in Hochiminh City, from January to April 2002, there were 132 recorded cases of food poisoning by water morning glory (water spinach)[2)].

Inspections of Vietnamese markets found that vegetables are contaminated with a high quantity of pesticides (including banned pesticides), nitrates and heavy metals. Contamination by pesticides is the most serious problem. For instance, according to the inspection results of the Hochiminh Plant Protection Department, vegetable samples in some markets of Hochiminh City exceeded pesticide residue limits in 2001 and 2002 by 8 and 6.6%, respectively (Anonymous, 2002). Moreover, in southern Vietnam, heavy metal (copper, zinc) contamination in plants is much higher than the acceptable concentration defined by the Ministry of Health (Higaki, 2002).

The above-mentioned problems occur due to lack of knowledge about agriculture techniques by farmers. Farmers have applied pesticides without controlling the amounts of use (Even some pesticides, which were supposed to be used limitedly, were used in large amounts and too often). Furthermore, they do not pay attention to trade names or labels of the chemical products and only apply the effective and economically viable pesticides (Phong *et al*., 1998). Besides, most farmers were using chemical fertilizer and rarely used organic fertilizer (Tuyen *et al*., 1998).

Through the safe vegetable program of the Vietnamese government, safe vegetables have been successfully produced and sold in some supermarkets and vegetable shops[3)]. Despite the need for safe vegetables, the quantities of safe vegetables, which are sold daily at supermarkets and safe vegetable stores, are still small, approximately 50-100 kg/day (Data from survey in 2004 and 2005). Therefore, this study was conducted to determine the factors that influence the consumption of safe vegetables in Vietnam. These factors could be social as well as economical. This study also tries to analyze the consumer's level of understanding, their attitude and perception of safe vegetable.

MATERIALS AND METHODS

The data and information of this study were collected through a postal survey (i.e., mail survey) and through direct interviews with consumers in Hochiminh City.

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Samples were taken from the households in the list of telephone directories of Hochiminh City. All households were randomly selected for the survey. In December 2004 and February 2005 questionnaires were mailed to selected households. Five hundreds questionnaires were sent to consumers in Hochiminh City, of which 300 responded, representing a 60% rate of response. Some questionnaires were not returned while some were returned by the post office due to changed addresses or unknown receiver. Because not all respondents provided answers to all questions, the number of respondents for the various questions was sometimes different. From survey results[4], the average family size of the households was 4-5 people with average monthly income of about 1,200,000 VND per person per month (less than 80 American dollars (USD) per person per month (at the time of the survey, 1 USD = 15,580 VND). It is suspected that this figure was probably under-estimated by the survey since people tend to be sensitive to release true income figures. People who responded were mainly female (75.5% of the sample group). However, 76.4% of responded households were responsible for food purchase and family meal preparation[5]. Therefore, we assumed that these households have concerning about our surveying questionnaires contents and they answered correctly what they know and want. Questions asked for information in the following areas: understanding of a variety of issues concerning safe vegetables; trust in vegetables, especially what are called safe vegetables in supermarkets and shops; price of safe vegetables, shopping habits, family size, children under 18 year of age and living conditions.

The collected data was processed and analyzed using the Statistical Package for Social Sciences (SPSS ver. 10). Multiple regressions (logistic regression) analysis was conducted in order determine how certain socio-economic factors affected consumption of safe vegetables. The variable description and how data was entered in the model is described in Table 1.

The results of these analyses will be used to make suggestions for increasing safe vegetable consumption in order to develop production of safe vegetables in Vietnam. The model was specified as:

$$Y = \frac{e^{\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5}}{1+e^{\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5}}$$

The linear model as: $\ln(Y/1-Y) = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5$.

Where Y = Whether one uses safe vegetables or not
And: X_1 = Age

Table 1: Description of the data variables collected during the study

Variable	Variable Description
Have used or haven't used safe vegetables have not been	The consumption of safe vegetables was the dependent variable. Value 0 means consumers using safe vegetables while value 1 represented consuming safe vegetables.
Income (total income of respondent family (if get married)	The variable was recorded as follows: 1 – Under 2,000,000 VND; 2 - between 2,000,000 and 4,000,000 VND; 3 -between 4,000,000 and 6,000,000 VND; 4 -between 6,000,000 and 8,000,000 VND. It was hypothesized that consumers with high incomes consume safe vegetables more than those with less incomes.
Education	Years of completed schooling. It was hypothesized that educated people were likely to be more careful with the type of food they consumed.
Age	The data on the age of the respondent was represented by two dummy variables. The first variable is given the value 1 if the respondent was aged between 27 and 55; otherwise it is given the value 0.
Children under age 18*	Have 1 or more children = 1; Do not have children = 0
Status*	Not married = 0; Married =1
Price*	Expensive = 1; Acceptable = 0
Sex*	Male = 1, Female = 0

*These variables were also included to find out whether they have influences on the consumption of vegetables or not

X_2 = Education
X_3 = Number of presence children (under 18 years of age) in a family
X_4 = Opinion about price of safe vegetables
X_5 = Income

Secondary sources of information were also used in the study. These included both published and unpublished papers. In addition, newspaper articles were referred to.

RESULTS AND DISCUSSIONS

General information on vegetable consumption in Hochiminh City: Hochiminh City is located in the center of South Vietnam and is the largest economic, commercial and financial center of Vietnam. The natural land area and population of the City are 2,095.01 ha and 6,062,993 people, respectively (Anonymous, 2004).

In 2004, the general retailing system of the area consisted of approximately 30 supermarkets and 100 markets (not including street markets, mobile markets), beside the street retailing market system and food shops etc. The retailing systems are developing in response to the rapid increase in population of the region (Mien *et al*., 2002). A Hochiminh City household typically consumes an average of 90 kg of vegetables per person per year and in 2010 consumption is expected to increase to 120 kg per person per year (Anonymous, 2002).

Consumer fears on vegetable contamination: Ranking of responses from Hochiminh City shows consumers' fear of

Table 2: Consumer's fear of unsafe vegetables

Reason	No. of responses	Percentage (%)
Contamination of pesticides	233	71.5
Contamination of nitrates	56	17.2
Contamination of intestinal parasites	20	6.1
Contamination of heavy metals	17	5.2
Total	326	100.00

(Consumer survey, 2004-2005)

unsafe vegetables (Table 2). Consumers in Hochiminh City regarded the use of pesticide contamination to be the most important health safety issue and hence ranked it number one. The contamination by too much chemical fertilizer (nitrates) was also an important concern. Bacteriological and heavy metal contamination was rarely mentioned. Figuié (2003) observed the same response from Hanoi consumers.

Consumer attitude towards the quality of safe vegetables: The above-mentioned results suggest that consumers pay attention to the safety of vegetables. However, the consumer's greatest concerning is the quality of the safe vegetables. In regard to the quality of safe vegetables, we discovered that supermarkets or safe vegetable shops have the trust of consumers who consider that most vegetables sold in supermarkets are safe and have good quality. In general, responded households had greater confidence in supermarket products than other markets. As shown in this study, 60.1% of households indicated that they were completely confident in vegetables sold in supermarkets, with 21.8% being undecided and 18.1% having no confidence (Table 3). The supermarket was thus seen as the only reliable source of safe vegetables when the consumers had no retailing salesman to trust. As cited by one respondent, "If you don't know anyone (i.e., vegetable retailer), go to the supermarket" (Son *et al*., 2003; Figuié, 2004).

Hochiminh households trust supermarkets because they believe that: all safe vegetables are checked before selling; supermarkets or safe vegetables shops know the origin of vegetables, know the producers or have annual purchasing contracts with some safe vegetable production companies, cooperatives, growers group etc. Therefore, supermarkets or safe vegetable shops have some level of control over the quality of safe vegetables. Some of the households interviewed in this study said that they thought vegetables in supermarkets were safe because the vegetables were prepared ready for cooking and were nicely packed, thus there was no need to wash before cooking (in the case of ready-to-cook vegetables)[6].

However, according to our survey in 2004 and 2005, it was found that almost no supermarkets checked the quality of vegetables before selling. Safe vegetables sold in the supermarkets had no quality certification,

Table 3: Confidence in safe vegetables in supermarkets, vegetable shops

Do you have confidence in safe vegetables sold in supermarkets and vegetable shops?	No. of responses	Percentage (%)
Yes	196	60.10
Undecided	71	21.80
No	59	18.10
Total	326	100.00

(Consumer survey, 2004-2005)

Table 4: Logistic regression coefficients of the factors for the use of safe vegetables

Variable	Xi	Coefficient	SE	Wald	Sig.
Constant		-12.533	2.696	21.613	0.000
Age	X_1	2.541	1.027	6.125	0.013
Education	X_2	0.272	0.127	4.608	0.032
Child	X_3	3.146	1.012	9.670	0.002
Price	X_4	-1.385	0.630	4.832	0.028
Income	X_5	0.973	0.220	19.637	0.000
Correct-Predictions (%)			92.7		
-2 log likelihood			82.977		
Cox and Snell R Square			0.650		
Nagelkerke R Square			0.877		
Model Chi-Square [df]			287.692[5]		
Block Chi-Square [df]			287.692[5]		

production information or trade mark. It was also determined that only a few of the supermarkets have annual contracts with vegetable growers, implying that some supermarkets do not know their suppliers well. Supermarkets do not clearly distinguish between safe vegetables and other vegetables. In most supermarkets ordinary vegetables were displayed side by side with safe vegetables.

In addition, it was noticed that the number of places selling safe vegetables were few and far[7]; consumers lacked knowledge[8] of food safety issues; the quality of safe vegetables was not stable[9] and the prices were high. As a consequence, until now, production and consumption of safe vegetables face many difficult problems.

Socio-economic factors influencing consumption of safe vegetables: The result from logistic regression analysis showed that income, presence of children, age, price and education level had a significant influence on the use of safe vegetables with 92.7% of correct predictions (Table 4). The -2 log likelihood value is rather small (82.977); Cox and Snell R Square, Nagelkerke R Square are moderately high (0.65 and 0.877 respectively) and the Chi-square value (287.692 [df = 5]) is significant at $p<0.0001$; therefore the model with age, price, children, income, education variables is an overall model fit. On the other hand, sex, status and others do not have a strong enough influence on the use of safe vegetables of Hochiminh City consumers.

The influence of income on the consumption of safe vegetables: The results from the model indicate that

Table 5: Proportion of consumers by their incomes

Income (1000) VND	Consume safe vegetables (%)	Do not consume safe vegetables (%)
>2,000	0	0
2,000- 4,000	6.3	93.8
4,000- 6,000	88.6	11.4
6,000-8,000	93.5	6.5

income has a significant influence on the consumer's purchasing decision of safe vegetables. The coefficient of the income variable has a Wald statistic equal to 19.637, which is significant at $p<0.0001$. It was observed that consumers with higher incomes consumed safe vegetables more than those with lower income (Table 5). This may be due to the fact that those with more money can afford to be more selective of diet and tend to be more conscious of the types of foods they consume and would want to lead a good life. In other words, high-income households pay more money for their families' health and are relatively more concerned about food safety issues than low-income households. Probably, with better income, consumers can afford to purchase higher quality foods at higher prices or buy them from high quality shops. Another reason may be that households with higher income have better access to information sources about food safety like newspapers, television, radio, etc.

The present result is support by other studies in food consumption that have attempted to link family income levels with people's attitudes towards risk. Kinnear *et al.* (1974) suggested that higher income groups in Canada were more concerned with food safety than lower income groups. Besides, some studies have shown that consumers with high incomes are more willing to pay high prices for pesticide-free vegetables (Ali *et al.*, 2003; Moustier *et al.*, 2002).

The influence of the number of children present in the household on the consumption of safe vegetables: The coefficient of the children variable has a Wald statistic equal to 9.67 which is significant at $p = 0.002$. The study revealed that having children influences the decision to consume safe vegetables. Of the total number of the households who consumed safe vegetables, 69.1% had at least one child compared to 96.5% of the households who did not have children younger than 18 years, have not consumed safe vegetables (Table 6). This suggests that those households with children are more interested in food safety than those without children and it is general agreement studies by Polacheck and Palacheck (1989), Jussaume and Judson (1992), who observed greater awareness of food safety hazards and increased concern about the risks associated with food consumption once people became parents.

Table 6: Proportion of consumers by number of presence children in the family

Have children?	Consume safe vegetables (%)	Do not consume safe vegetables (%)
Yes	69.1	30.9
No	3.5	96.5

Table 7: Proportion of consumers by their age

Age	Consume safe vegetables (%)	Do not consume safe vegetables (%)
<27 and >55	4.3	95.7
27-55	59.0	41.0

The influence of age on consumption of safe vegetables: The differences in age between the group were statistically significant at $p = 0.013$. Results showed that consumers between 27-55 years of age consumed safe vegetables more than those less than 27 or over 55 years of age. In other words, middle-aged people tended to be more careful with what they consume than younger or older people. Of those consuming safe vegetables in this survey, 59.0% were in their middle age while only 4.3% of those less than 27 or above 55 years old did (Table 7). This may be attributed, in part, to the fact that most households 27-55 years of age generally have stable jobs, families, many social relationships, so that they may have greater access to information about food hazards and, thus, may also have a stronger interest in using safe vegetables than younger or older consumers. Old people tend to resist change and this might be playing a big role. Hawkes and Stiles (1986) associated age and educational levels with consumer perceptions of risk. Our result is in general agreement with a study by Webster (1975) who found that age was the most important predictor of consumer risk aversion.

The influence of price on the consumption of safe vegetables: The coefficient of the price variable was negative and statistically significant at $p = 0.028$ (Wald = 4.832). This factor has a counter influence on the consumption of safe vegetables. Following the law of supply and demand, as the price of a product increases, its demand decreases. The high price of safe vegetables is one of the major factors that influence its consumption (Table 8). Safe vegetables are relatively more expensive than ordinary vegetables. In supermarkets, safe vegetables (salads, cucumbers, cauliflower etc.) are mostly sold at double or triple the price of the same kinds of ordinary vegetables (Table 10). About 59% of households mentioned high price as the main constraint in consuming safe vegetables.

The economic efficient makes consumers unwilling to pay more money for protecting their families' health. The high price of safe vegetables is a serious problem for households who have low incomes. Low-income people

Table 8: Proportion of consumers by their opinion about the price of safe vegetables

The opinion about price (%)	Acceptable (%)	Expensive (%)
Consume safe vegetables	21.5	87.7
Do not consume safe vegetables	78.5	12.3

Table 9: Proportion of consumers by their educational qualification

Educational qualification	Consume safe vegetables (%)	Do not consume safe vegetables (%)
High school	6.47	93.53
Above high school	64.17	35.83

Table 10: The comparison of prices of safe vegetables and ordinary vegetables

Vegetable	Safe vegetables (Vietnam $)	Ordinary vegetables (Vietnam $)	Difference (%)
Cabbage	5,100	2,800	82.14
Carrot	8,300	7,000	18.57
Lettuce	14,500	8,000	81.25
Potato	10,000	10,500	-5.00
Cauliflower	11,900	4,500	164.44
Broccoli	10,000	6,000	66.67
Celery	5,200	4,200	23.81
Spinach	7,200	5,600	28.57
Cucumber	5,300	3,500	51.43
Green peas	27,000	25,000	8.00
Green onion	20,000	18,000	11.11
Wax gourd	5,000	3,000	66.67
Bitter gourd	5,600	3,500	60.00
Japanese squash	5,000	4,200	19.05

(Consumer survey, 2004-2005)

or those who look for the lowest prices are usually victims of food poisoning (i.e. they consume unsafe vegetables or they were cheated by retailers (who packed ordinary vegetables by proper cleaning to make them look safe). Furthermore, these consumers rarely receive information from television, newspaper etc. and as a result they are unaware problems associated with unsafe vegetables.

The influence of education on consumption of safe vegetables: The coefficient of education variable had a Wald value equal to 4.608, which was statistically significant at $p = 0.032$ between the groups. The study revealed that 66% of the respondents that have not consumed safe vegetables did not attain an education above high school qualification (Table 9). With low education, they may not think about the long-term implications of consuming unsafe vegetables.

Educated consumers are more aware and knowledgeable of the nutritional value of food and the consequences of consuming contaminated vegetables. Their confidence in the safety of foods is strengthened by their awareness that the food they purchase on the market must meet quality standards. Our study shows a similarity with Smith and Riethmuller (2000) who concluded that educating consumers would enable them to decide for themselves whether the risk involved in food consumption was sufficient to justify changing their consumption habits.

Although there were many reasons that determined consumption of safe vegetables, it is obvious that whether or not to buy safe vegetable is becoming an important consideration to the consumer when making purchasing decisions. According to Kramer (1990), consumer concerns can frequently translate to market behaviour in a volatile way. It is clear that concern for food safety can have an effect on future trends in consumption.

CONCLUSIONS AND SUGGESTIONS

This study revealed that consumers were aware of food poisoning caused by vegetable contamination. It can also be concluded that the consumers have the wish to consume safe vegetables for the sake of good health. We found that the consumption of safe vegetables was hampered by some socio-economic factors. The results of logistic regression showed that price, income, education, age and the number of presence children in a family significantly affected the consumers' decision to buy safe vegetables.

Although there was no evidence of quality certification by supermarkets, consumers indicated that they purchased their vegetables at these places because they believed that the vegetables from these were safe. However, Hochiminh City consumers would likely use safe vegetables if safe vegetables have quality certification or at least have original information on the product. Moreover, it was noted that the number of supermarkets and safe vegetables shops were few and far; many issues regarding safe vegetables are not properly understood and rather important deciding condition to select vegetables is apparent. Therefore, in order to promote the consumption of safe vegetables and prevent food poisoning, there is a strong need to intensify civic education to both producers and consumers. Food poisoning and its effects could be taught in schools with the hope that in the long run all consumers could take the issue seriously. Information on the safe production of vegetables as well as the dangers of applying high amounts of fertilizer and pesticides should be given to all producers. Development of cheaper methods in vegetable production and reducing the number of middlemen in the marketing channel would help to bring down the price of safe vegetables. Opening more vegetables shops closer to the living areas would assist consumers access to safe vegetables. This may necessitate the producers to form groups and open vegetable shops near the consumers' living areas. Government intervention in terms of policy formation and enforcement would help to produce safe vegetables. Regulations on acceptable levels of fertilizers and pesticides should be formulated and enforced. Frequent checks in both supermarkets and local markets

would prevent contaminated vegetables from being sold to consumers. In temporary, at the supermarkets and shops, packaging with a label mentioning the information of the product, the date of production and expiration, the name and address of producer would help gain trust of the consumers. Ministry of Health (or the Plant Protection Department etc.) should periodically check the vegetables sold and issue certification of the products.

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NOTES

1) Safe vegetables can be defined as products of raw vegetables (including vegetables from roots, trunks, leaves, flowers and fruits) with the quality of their strains, the concentration of poisoning substances (pesticides, nitrate and heavy metals), harmful organisms (*E. coli*, Salmonella and intestinal parasites) under permissible limits and safe for the consumer and environment. The vegetables must be harvested in a timely manner and in the proper way to avoid contamination (Anonymous, 1998).
2) Fifty nine cases of food poisoning caused by water morning glory in the first week of May, Vietnam news, July, 5th 2002 Hochiminh Phu nu newspaper (source: Hochiminh Women paper). http://www.vnn.vn/pls/news/ext_utls.htnoidung (1,57054,1).
3) Afterward, we have interviewed 26 households directly. As a result, in total there were 326 completed questionnaires. From here, the calculated figures include the questionnaires done by the interview.
4) During the survey, at present, safe vegetable have been sold in supermarkets and safe vegetable shops only.
5) This indicated that in some households the men were responsible for purchasing food instead of females (In Vietnam, until now, women are normally in charge of this household job, event if they have another job outside the home). This custom has changed little recently.
6) At present several supermarkets sell "ready-to-cook" vegetables that are ordinary vegetables with the old, damaged leaves and roots removed. They are cleaned and washed and made ready for fast cooking.
7) The consumers felt that supermarkets that sold safe vegetables were very far away. On average the consumers covered a 5-6 km-long distance from their homes to the nearest supermarket in the City center. Apart from being time consuming, they were not sure whether the vegetables they bought were indeed safe vegetables or not.
8) At present, safe vegetables are being sold in some supermarkets and stores without quality certification (issued by government relevant organizations or an independent third party) or product information. The quality of safe vegetables is not controlled properly and regularly.
9) Some consumers did not properly understand many issues regarding safe vegetables. During the survey, many households though that safe vegetables were synonymous with organic vegetables. Some consumers defined safe vegetables as clean, fresh, and ready to cook vegetables. Moreover, they believed that they could make vegetables safe by washing carefully, using vegetable cleaning detergent, salty water or cooking them well. Figuié also well found that the water used to wash rice is as well used to wash vegetables, because it is reputed to have cleansing properties (Figuié, 2003). Visual appearance seemed the factor used in selecting which vegetables to buy at the market. Good looking, undamaged, without insects were the priority conditions for the consumer choices (Figuié, 2004).

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